

HEALTH CONSULTATION

Evaluation of Off-Site Contamination into the Unnamed Tributary of Prairie Creek

SENTINEL WOOD TREATING COMPANY
(a/k/a SENTINEL WOOD TREATING COMPANY, INCORPORATED)

[EPA FACILITY ID: MOD029684438](#)

AND

12TH AVENUE SOLVENTS

[EPA FACILITY ID: MON000704015](#)

AVA, DOUGLAS COUNTY, MISSOURI

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Prepared by:

Missouri Department of Health and Senior Services
Section for Environmental Public Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

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STATEMENT OF ISSUES AND BACKGROUND

Statement of Issues

The Missouri Department of Health and Senior Services (DHSS), in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR), has prepared this [health consultation](#) at the request of the US Environmental Protection Agency (EPA) to determine if the off-site migration of [contaminants](#) from the Sentinel Wood Treating site and the 12th Avenue Solvents site are likely to pose a [public health hazard](#) and to provide a discussion of soil results for one garden area.

Background

In a previous health consultation prepared by DHSS, titled "Evaluation of Off-Site Contamination, Sentinel Wood Treating Site," dated August 2, 2001, it was determined that [exposures](#) to contaminants migrating off of the Sentinel Wood Treating site pose an [Indeterminant Public Health Hazard](#) (1). This health [hazard](#) category was based on the following conclusions:

- Contaminants migrating from the Sentinel Wood Treating site and other unknown sources, are contaminating the unnamed tributary to Prairie Creek leading to levels of potential public health concern, especially for children and sensitive populations.
- Data gaps exist for one family garden area, and for the source of volatile organic compound (VOC) contamination.
- Levels of contaminants migrating from the Sentinel Wood treating site and other unknown sources could be increasing over time in the unnamed tributary to Prairie Creek. Continued sampling and future monitoring are necessary to insure the public's health (1).

Since the publication of the August 2, 2001 Health Consultation, EPA and the Missouri Department of Natural Resources (MDNR) have provided DHSS with additional information and data that will allow for a more complete evaluation of human exposure and associated public health impact. In addition, an error was found in the August 2, 2001 document. The value for 2,3,7,8, tetrachlorodibenzo-p-dioxin (dioxin, TCDD) was used in the calculations for adverse health effects in that document. Instead, the Toxicity Equivalent (TEQ) value of all the related dioxin compounds including 2,3,7,8, TCDD should have been used. This error will be corrected in this document.

The Sentinel Wood Treating site and the 12 Avenue Solvents site lie adjacent to each other north of 12 Avenue (Missouri Highway 14) in Ava, Missouri (see [Figure 1](#) in the Appendix). Two unnamed streams converge at the northern edge of the Sentinel property, then converge with a stream from the west into an unnamed tributary to Prairie Creek which flows across the property, under the highway, through a residential area and a city park into Prairie Creek (1).

Reportedly, all the residents within 1/4 mile of the sites are on city water. There are private wells that are more than 1/4 mile from the sites that are currently in use as household water supplies.

The unnamed tributary to Prairie Creek has been determined by MDNR to be both a gaining and a losing stream (4). In the upper stretches of the tributary (near the Sentinel site) it generally gains water from shallow groundwater and the surface, while downstream some stretches of the tributary lose water underground (4). These features of Karst topography could be allowing shallow groundwater contamination from the 12th Avenue solvents site and surface runoff from the Sentinel site to flow into the unnamed tributary to Prairie Creek. These and other Karst features, such as cracks and fractures in the bedrock, caves, and springs could also lead to the mixing of the contaminated shallow aquifer with deeper aquifers (used for private and public wells).

The unnamed tributary to Prairie Creek is a seasonally intermittent stream. The water levels and water current fluctuate with the amount of rainfall in the area. Generally, in the spring and fall the stream holds water, while in the summer it can be nearly dry. Seasonal fluctuations in the rainfall, water levels and water currents could result in the migration and deposition of contaminants from the sites via surface water runoff from the sites over time. At different times of the year, and at different areas of the creek, the levels of contaminants could be higher or lower than those found in previous sampling events.

It is unreasonable to believe that people in the area have constant direct contact with the unnamed tributary to Prairie Creek for every day each year. In order to determine if exposures to contaminants in the tributary are likely to cause adverse health effects, a reasonable exposure scenario must be developed. For this consultation, the exposure was adjusted to be four hours a day, for 90 days a year. This would be equal to someone visiting the creek every day for four hours for the three summer months of the year. DHSS chose this exposure scenario due to the evidence of creek use found in a site visit conducted in May 2001 (1). Numerous examples of activity along the creek were observed including; litter, well-worn paths through vegetation, children's toys such as dump trucks and cars, fire rings, minnow traps, picnic tables, etc. (1). Children were also observed playing in the creek and washing rocks (1).

Garden Soils

MDNR has provided DHSS with data for one family garden area. Nine soil samples were collected in February 2001 and analyzed for 147 various chemicals. In one sample, SS-06, five different [Volatile Organic Compounds \(VOCs\)](#) were detected. The VOCs detected (n-propylbenzene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, sec-butylbenzene and p-isopropyltoluene) are at extremely low levels, below health [comparison values](#). Exposures to these chemicals are not expected to cause any adverse health effects resulting from gardening activities or eating fruits/vegetables from the garden. In four of the nine samples analyzed, pentachlorophenol (PCP) was detected in garden soils. Results of the analysis of these samples are reported in [Table 1](#).

Table 1. Garden Soil Sample Results for pentachlorophenol
All results in parts per billion (ppb)

| Sampling Location | SB-30 | SB-31 | SB-32 | SB-32 | EMEG* |
|-------------------|----------|----------|----------|------------|-------|
| Depth | 0-2 feet | 0-1 foot | 0-1 foot | 4.5-5 foot | |
| pentachlorophenol | 370 | 780 | 500 | 300 | 5000 |

SB-30= Soil Boring Number 30.

EMEG = ATSDR's Environmental Media Evaluation Guide.

Depth = Depth below surface level where the sample was collected.

Sources Contaminating Tributary

The two hazardous waste sites, known to be sources of contamination in the unnamed tributary to Prairie Creek, are discussed in the following sections. EPA is still investigating to see if other sources are contributing to the contamination in the tributary.

Sentinel Wood Treating Site

EPA has provided DHSS with historical information regarding releases to Prairie Creek from the Sentinel Wood Treating Site. Records indicate that Sentinel Wood Treating has been aware of possible waste discharge to Prairie Creek as early as 1961 (2). Additionally, samples taken in Prairie Creek in the 1970's ranged from 63.5 ppb -590 ppb of PCP (2,3). Because no sampling points were given, it is difficult to determine what the [concentrations](#) in the unnamed tributary to Prairie Creek would have been. However, this information does indicate that there were completed exposure pathways in the past that might have been higher than those presently found in the tributary.

Recent sampling of the unnamed tributary to Prairie Creek indicated that dioxin was present in the sediments of all five of the areas sampled. [Table 2](#) reports the results of the analysis of sediment samples collected from five areas of the tributary. The five areas referenced in [Table 2](#) are locations along the unnamed tributary to Prairie Creek from the Sentinel site, south to the city park. Area 1 is up-gradient of the drainage ditch south of 12th Ave, Area 2 is in the drainage ditch, Area 3 is in the creek down-gradient from the confluence with the drainage ditch, Area 4 is ½ mile downstream from 12th Ave north of the city park, and Area 5 is near the city park.

Table 2. Sediment Sample Results collected from the unnamed tributary to Prairie Creek

| Sampling Location | Area 1 | Area 2 | Area 3 | Area 4 | Area 5 | LOC* |
|---|------------------|-----------------|-----------------|-----------------|-----------------|------------------|
| 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) | 6.4 ppt | 1.32 ppt | 1.12 ppt | 31.1 ppt | 2.33 ppt | 1000 ppt |
| 2,3,7,8-TCDD toxicity equivalent (TEQ) | 483 ppt | 89 ppt | 71.5 ppt | 2920 ppt | 131 ppt | 1000 ppt |
| benzo(a)pyrene | 9,300 ppb | ND | 640 | NA | NA | 680 ppb** |

ND = Not Detected

NA = Not Analyzed

LOC* = Missouri Department of Health and Senior Services Level of Concern

** Missouri Department of Health and Senior Services Any Use Soil Level

ppt = parts per trillion

ppb = parts per billion

see appendix for [map of sampling areas](#)

12th Avenue Solvents Site

A second CERCLIS site, the 12th Avenue Solvents site, is another source of contamination that was discovered in the unnamed tributary to Prairie Creek (5). The 12th Avenue Solvents site, is located at a facility, owned by the Copeland Corporation, at 1400 NW 3rd Street in Ava, Missouri (see [Figure 1, Site Map](#), in the Appendix) (5). The 12th Avenue Solvents site, is located north of 12th Avenue and east of the Sentinel site. The western boundary of the site is 3rd Street. To the south of the site (south of 12th Avenue) is the Douglas County Health Department. There are two businesses on the 12th Avenue Solvents site, Rawlings and Copeland (see [Figure 2](#) in the appendix).

In March 2001, a Phase One Soil and Groundwater Investigation at the 12th Avenue Solvents site along the south and west portions of the Copeland property and along the north portion of a vacant parcel of land owned by the Douglas County Health Department (DCHD) was completed (5). On-site soils and groundwater, and off-site migrations of groundwater were being investigated at this site because of the presence of VOC contamination in the unnamed tributary to Prairie Creek.

The DCHD parcel lies west of the health department building and south of 12th Avenue. In the past, this parcel was very swampy. In some areas, it remains swampy/marshy (5). In an effort to drain the area for possible development, a PVC drain pipe was installed approximately five years ago, that moves water into a ditch which runs into the unnamed tributary to Prairie Creek.

A soil sample collected between seven and eight feet below ground surface in one area of the site contained concentrations of ethylbenzene at 140,000 parts per million (ppm), xylenes at 680,000 ppm, 1,1,1-trichloroethene at 190 ppm and toluene at 260 ppm (5). This sample represented the highest levels of these chemicals in soils on the site (5). The results of soil sampling showed that arsenic, copper, chromium, and lead were detected along the western and southern portions of the site (5). The onsite soil contamination is serving as a source of continuing ground water contamination.

The analytical results of the off-site groundwater sampling indicate that ethylbenzene, xylenes, trichloroethene, and cis,1,2-dichloroethene were detected in samples at levels above the EPA's Maximum Contaminant Levels (MCLs) for drinking water (5). An MCL is the maximum permissible level of a contaminant in water that is delivered to the free-flowing outlet of the ultimate user of a public water system (5). [Table 3](#), lists the groundwater contaminants that were found on the northern edge of the DCHD parcel (5). Because the shallow groundwater in the area has been contaminated by the 12th Avenue Solvents site, this pipe is acting as a conduit for the off-site migration of VOC contaminants from the site into the unnamed tributary to Prairie Creek.

Table 3. Groundwater Sampling Results - Douglas County Health Department - off-site (5)
Levels Reported Above the MCL
Volatile Organic Compounds (reported in ppb)

| Sampling Location | cis-1,2-dichloroethene | ethylbenzene | trichloroethene | xylene |
|-------------------|------------------------|--------------|-----------------|--------|
| DP-16 | | 1,400 | | 14,000 |
| DP-17 | 110 | 3,100 | 160 | 23,000 |
| DP-18 | | 6,100 | | 31,000 |
| DP-19 | 86 | 5,000 | | 27,000 |
| DP-00-2 | | 4,900 | | 26,000 |
| DP-20 | 95 | 1,200 | 110 | |
| MCL | 70 | 700 | 5 | 10,000 |

DP-16 = Direct Push Hole 16

*Blank Spaces in the table means the sample result was found to be below the MCL

Sampling Locations are noted on [Figure 2](#) in the appendix

Adjacent to the 12th Avenue Solvents site to the south is the City of Ava's Public Well #4 (1). Previous testing by the city, MDNR, and EPA, has found no VOC contamination in City Well #4 (1). Because the city well, which is down gradient and much deeper is uncontaminated, these data suggest, the VOC groundwater contamination on the Copeland property appears to be confined to a shallow groundwater aquifer (1). Monitoring wells on the Copeland property also confirm this conclusion (5).

DISCUSSION

Garden Soil

One family garden area was tested for soil contamination. Surface soils were found to contain very low levels of five VOCs, (n-propylbenzene, 1,3,5-trimethylbenzene, 1,2,4-trimethylbenzene, sec-butylbenzene and p-isopropyltoluene). Because VOCs dissipate into the air rapidly, and because the VOC contaminants were found at very low levels below health comparison values, VOC exposures from gardening activities or eating produce from the garden are not expected to cause adverse health effects. Pentachlorophenol (PCP) contamination was found at various depths below the ground surface (0-5 feet). The levels of PCP found in garden soils are well below ATSDR's Environmental Media Evaluation Guide (EMEG). EMEGs are media specific guidelines (air, water, soil) used to determine whether there is a need to further investigate exposures to chemicals for their possible health effects. Levels below an EMEG are unlikely to pose a health threat. Exposures to PCP contamination from gardening activities or eating produce from the garden are not expected to cause adverse health effects.

Although garden soils contain very low levels of contamination, it is always wise to avoid voluntary exposures to hazardous chemicals. The use of gardening gloves is a simple measure that can be taken to reduce contact with contaminated soils. As with any fruits or vegetables, it is important to properly wash or peel the fruits and vegetables from the garden before consuming them.

On-Site Contamination

The amount of on-site soil contamination at the Sentinel Wood Treating site and the 12th Avenue Solvents site is of great concern(1,5) because it is contributing to the contamination of shallow groundwater. Also of high concern, is the shallow groundwater contamination migrating from the 12th Avenue Solvents site (5). If nothing is done to stop off-site migration of contaminants into the unnamed tributary to Prairie Creek, it is possible that the levels of contamination in the stream could increase over time and pose a threat to health. In addition to concerns for surface water contamination, both sources have the potential to contaminate nearby public and private drinking water wells.

Exposure Analysis for Off-Site Contamination

To determine whether the residents of Ava are exposed to contaminants migrating from the site, DHSS evaluated the environmental and human components that lead to human exposure. This pathways analysis consists of five elements including a source of contamination, transport through an environmental medium, a point of exposure, a route of human exposure and a receptor population. ATSDR categorizes an exposure pathway as completed or potential if the exposure pathway cannot be eliminated. An exposure pathway can be eliminated if at least one of the five elements is missing and will never be present. Completed pathways require that the five elements exist and indicate that exposure to a contaminant has occurred in the past, is currently occurring, or will occur in the future. Potential pathways, however, require that at least one of the five elements is missing but could exist. Potential pathways indicate exposure to a contaminant could have occurred in the past, could be occurring now, or could occur in the future.

Completed Exposure Pathways

In the past and present people have been exposed to contaminated surface water and sediment along the unnamed tributary to Prairie Creek(1-5). This exposure could continue into the future if nothing is done to control the sources. Chemical exposures are occurring through inhalation of VOCs from surface water and sediment, incidental ingestion of surface water and sediments containing contaminants, and dermal (skin) contact with surface water and sediments containing contaminants. The sources of PCP, benzo(a)pyrene, and 2,3,7,8-TCDD contamination are believed to be related to the disposal of contaminants on the Sentinel Wood Treating site in the former lagoons and releases from the former treatment area (1). One source of VOC contamination has been identified as the 12th Avenue Solvents site (5). EPA continues to investigate for other possible sources of contamination in the tributary. The environmental media is contaminated surface water and creek sediment. The point of exposure is in and around the unnamed tributary to Prairie Creek. The

exposed population is anyone that frequents the unnamed tributary to Prairie Creek. The time frame for the completed exposure pathway is the past, and present.

Potential Exposure Pathways

Present and future potential exposure pathways exist for the unnamed tributary to Prairie Creek. Because gross soil contamination exists on-site at the Sentinel Wood Treating facility, there is a potential for greater migration of contaminants into the unnamed tributary to Prairie Creek as well as the potential for other media such as groundwater to become contaminated. Soils and shallow groundwater are already highly contaminated at the 12th Avenue Solvents site and have been documented to be migrating off-site (on the DCHD property) in the direction of the unnamed tributary to Prairie Creek. There is also a potential for the shallow groundwater contamination to migrate and contaminate public and private wells in the area. A sampling plan to monitor public and private wells for VOC contamination needs to be designed and implemented in order to insure that area residents are not unknowingly drinking contaminated water.

CHEMICALS OF CONCERNS

2,3,7,8-TCDD and related compounds

Levels of 2,3,7,8-TCDD and related compounds found in and around the unnamed tributary to Prairie Creek are above 1 part per billion (ppb) which is the Missouri Department of Health and Human Services Level of Concern (LOC). DHSS considers a level of more than 1 ppb TCDD in residential surface soil and dust to be of health concern. The TEQ value for TCDD compounds in sediments collected in area 4 of the unnamed tributary to Prairie Creek are nearly three times higher than the LOC. The other four areas sampled had TEQ values lower than the LOC.

Although it is unlikely that people are going to spend the entire amount of time in the exposure scenario (four hours a day, 90 days a year) in area 4, there is evidence that some people may be using area 4 more than other areas of the tributary. Sampling area 4 is located adjacent to a private residence. There is also evidence (well-worn paths in the grass) that people access the tributary near this area. Because of the nature of the unnamed tributary to Prairie Creek (it is seasonally intermittent, and gains and loses), the levels of 2,3,7,8-TCDD may be fluctuating with the washing and depositing of sediments throughout the creek. At different times of the year, and at different areas of the creek, the levels of contaminants could be higher or lower than those found in previous sampling events. Future monitoring both in the same areas sampled and at other areas in the creek will be an important tool to insure the public's health.

2,3,7,8-TCDD has been associated with a wide variety of adverse health effects in animals and humans (6). TCDD exposure has been associated with liver damage, immune system damage, adverse reproductive effects, and cancer, although these effects have mostly been observed in animal studies, or in studies where individuals were exposed occupationally to TCDD (and probably to other chemicals which were also thought to cause health problems) (6). None of these health effects are expected from exposures to TCDD near the unnamed tributary to Prairie Creek. However, the levels of TCDD in on-site soils at depth are much greater, and may have the potential to cause some of these effects. Changes in blood and urine, which may indicate liver damage, have been observed in people at levels that are higher than those found off-site, but similar to those found on-site (6). Alterations in the ability of the liver to metabolize hemoglobin, lipids, sugar, and protein have been reported in people exposed to concentrations of TCDD higher than those found on and off site(6). A slight increases in the risk of diabetes and abnormal glucose tolerance tests have been observed in some studies of people exposed to TCDD at moderately high levels which are similar to those on-site(6).

In many animal species, the immune system appears to be extremely sensitive to TCDD (6). At relatively low levels, TCDD weakens the immune system and causes a decrease in the system's ability to fight foreign substances such as bacteria and viruses (6). Effects on all types of mediated immunity were seen at doses of TCDD as low as 0.01 micrograms per kilogram (ppb). Exposure to TCDD can cause reproductive damage

and birth defects in animals, including altered levels of sex hormones in both sexes, and reduced production of sperm these are not expected health effects at this site (6). In addition, bleeding, skeletal deformities, kidney defects, weakened immune responses, impaired reproductive system development, and learning and behavior impairments have been observed in offspring of animals exposed to TCDD (6). These health effects were found in studies that used doses higher than expected at this site (6).

Pentachlorophenol (PCP)

Currently, the levels of PCP in and around the unnamed tributary to Prairie Creek are low when compared to studies of the effects of the chemical on humans and animals and adverse health effects are not expected from exposures to PCP(7). Historical data shows that the levels of PCP in the unnamed tributary to Prairie Creek may have been much higher in the past, due to discharges of materials when the Sentinel site was operational. Because the data is limited, scattered over several years, and no locations or sampling information was included with the data, it is difficult to determine with certainty if people were being exposed to levels of contamination that would have caused adverse health effects from the unnamed tributary to Prairie Creek.

Benzo (a) pyrene

Levels of benzo(a)pyrene in the sediment of the unnamed tributary to Prairie Creek are low when compared to studies of the effects of this chemical on humans and animals, and adverse health effects are not expected to occur at current levels of exposure to off-site contaminants (8). However, the levels of benzo(a) pyrene on-site at the Sentinel Wood Treating facility, are much higher than levels off-site, and have the potential to move off-site in the future. This means that there is a potential for adverse health effects from future migration of benzo(a)pyrene if off-site migration is not eliminated.

Volatile Organic Chemicals

Levels of xylene, ethylbenzene, and cis-1,2-dichloroethene in the unnamed tributary to Prairie Creek are low when compared to studies of the effects of the chemical on humans and animals and adverse health effects are not expected at levels currently found in the creek (9-11). However, levels of VOCs in sub-surface soils and shallow groundwater on the 12th Avenue Solvents site are similar or higher than the levels in some human and animal studies (1, 9-11). Because off-site migration of VOCs has already occurred in shallow groundwater onto the DCHD property, exposure to higher levels of VOCs could occur in the future. Monitoring of groundwater migration will be an important tool to insure the safety of the public's health.

Exposure to Multiple Chemicals

Contamination in the unnamed tributary to Prairie Creek consists of a mixture of chemicals that are traveling from multiple sources. Very few health studies have considered effects from mixtures of chemicals, which makes health effects from exposures to mixtures of hazardous chemicals difficult to determine. Just as medications can have very different effects if taken alone or in combination with other medications, effects from exposures to mixtures of hazardous compounds could be additive, could not effect one another, or could detract from one another. In general, it is understood that if more than one compound effects the same organ or system in the body, that exposure to the mixture is more harmful than if exposure was only to one chemical (6-11).

All of the chemicals of concern (PCP, TCDD, benzo(a)pyrene, xylene, cis-1,2-dichloroethene, and ethylbenzene) found in the unnamed tributary to Prairie Creek are known to effect the kidney and liver (6-11). TCDD, PCP, cis-1,2-dichloroethene, and ethylbenzene are known to effect the immune system and blood (6,7,10,11). Xylene and TCDD are known to have adverse effects on the reproductive system and brain (6,9). When exposures to individual chemicals of concern (excluding dioxin) found in the unnamed tributary to Prairie Creek were analyzed, the exposures did not individually pose a health hazard. However, people frequenting the unnamed tributary to Prairie Creek are actually being exposed to a mixture of chemicals that effect some of the same target organs and systems. Exposure to this mixture of chemicals may have a magnified health effect that is of health concern.

Cancer

Ethylbenzene, pentachlorophenol, 2,3,7,8-tetrachlorodibenzo-p-dioxin, and benzo(a)pyrene are all believed to cause cancer in humans. The Environmental Protection Agency (EPA) has developed cancer unit risk factors that can be used to determine the theoretical cancer risk for adults exposed to hazardous chemicals. Cancer risks are calculated over a lifetime, which is estimated at 70 years. The American Cancer Society estimates that in America, half of all men and one-third of all women will develop some form of cancer in their lifetime (12). DHSS has calculated the cancer risk for the contaminants that are migrating off-site from the Sentinel Wood Treating site and the 12th Avenue solvents site into the unnamed tributary to Prairie Creek. Overall, there is an elevated risk of developing cancer from a lifetime of exposure to the combination of chemicals found in surface water and sediments off-site in the unnamed tributary to Prairie Creek. However, we would not expect an increase in the cancer rate for people living near the site or the unnamed tributary to Prairie Creek. Because residents and visitors would not spend their entire lifetime adjacent to the site, and are not expected to have daily contact with contaminated sediments and surface waters, it is unreasonable to believe that the actual cancer rate among residents and visitors would increase.

Children and other Sensitive Populations

A sensitive population will exhibit a different or enhanced response to hazardous chemicals than will most persons exposed to the same level of hazardous chemicals in the environment (8). Reasons may include genetic makeup, age, health and nutritional status, and exposure to other toxic substances (8). In general the elderly, with declining organ function and the young with immature and developing organs, will be more vulnerable to toxic substances than healthy adults (8). Because children often play in the dirt and sediment and put their hands in their mouths, ingestion of contaminated soils and sediment may be a more important source of TCDD and benzo (a) pyrene exposure for children than adults at this site (10,11). Incidental ingestion of contaminated surface-water is not expected at this site, however, children are more likely than adults to incidentally ingest surface-water from the unnamed tributary to Prairie Creek potentially exposing them to greater amounts of harmful chemicals. Inhalation exposure to VOCs are occurring at the creek. Because children are smaller than adults and may be in closer contact with the creek tributary, inhalation exposures to xylene, ethylbenzene and cis-1,2-dichloroethene may be greater for children. People with chronic disease or weakened immune systems may be more susceptible to the harmful effects of hazardous chemicals than those without chronic disease. Because many of these chemicals affect the same target organs people with liver and kidney disease may also experience more serious health effects than those that are healthy.

CONCLUSIONS

1. Based on the available data, and likely exposure scenarios, DHSS has determined that exposures to contaminants in the Sentinel Wood Treating site and the 12th Avenue Solvents site area pose a public health hazard. Preliminary data indicate that the Sentinel Wood Treating and 12th Avenue Solvents sites are sources of contamination, but other sources are possible.
2. Dioxins in creek sediments are at levels of health concern especially for children and sensitive populations. Historically, PCP in the unnamed tributary to Prairie Creek may have been at levels that could have caused adverse health effects. Limitations in the data make it difficult to determine with certainty at what levels exposures occurred or if adverse health effects from historic exposures are likely.
3. Current data indicates that the unnamed tributary to Prairie Creek may receive groundwater discharges from areas known to have PCP and VOC contamination. If additional data reveal that in fact the tributary receives contaminated groundwater discharges, exposure to contaminated surface water could be of health concern.
4. Data from one family garden area indicate that levels of contaminants are very low and are not

at levels expected to cause adverse health effects.

5. There is the potential for continued off-site migration of contaminants from the Sentinel Wood Treating Site and the 12th Avenue Solvents site. The Karst geology in this area could allow for the acceleration of the migration of contaminants and significantly impact private and public drinking water sources. Continued sampling and future monitoring of contaminant levels in the tributary and in drinking water wells are necessary to insure the public's health.

RECOMMENDATIONS

1. Conduct additional sampling to assess the surface water quality in Prairie Creek and its unnamed tributary. If investigations reveal surface water contamination at levels of health concern, take measures to reduce or eliminate human exposures to these contaminants.
2. Develop and implement a sampling plans to monitor public and private wells to insure that area residents are not unknowingly drinking contaminated water.
3. Determine the horizontal and vertical extent of affected groundwater migrating toward the marsh south of 12th Avenue and the unnamed tributary to Prairie Creek. Determine if other possible sources are contributing to the contamination of in the unknown tributary to Prairie Creek.
4. Regulatory agencies should further define the nature and extent of contamination and provide that information to DHSS so that they can better define the pathways of exposure and take actions to mitigate and prevent exposures.

PUBLIC HEALTH ACTION PLAN

This Public Health Action Plan (PHAP) for the Sentinel Wood Treating Site and the 12th Avenue Solvents site contains a description of actions to be taken by the Missouri Department of Health and Senior Services (DHSS), the Agency for Toxic Substances and Disease Registry (ATSDR), and others. The purpose of the PHAP is to ensure that this health consultation not only identifies public health hazards, but also provides an action plan to mitigate and prevent adverse human health effects resulting from past, present, and/or future exposures to hazardous substances at or near the site. Included is a commitment from DHSS and/or ATSDR to follow up on this plan to ensure that it is implemented. The public health actions to be implemented by DHSS, ATSDR and/or cooperators are as follows:

Ongoing Activities

1. DHSS/ATSDR will coordinate with the appropriate environmental agencies to continue to address community health concerns as they arise.
2. DHSS/ATSDR will continue to meet with families that live along the unnamed tributary to Prairie Creek and provide health education to reduce and eliminate exposures to hazardous chemicals.
3. DHSS/ATSDR will develop and implement a health education plan for the Sentinel Wood Treating Site and the 12th Avenue Solvents site which will focus on ways to reduce or eliminate incidental exposures to contaminated soils, surface waters, and groundwater on- and off-site. This plan will highlight hand washing after outdoor activities and avoiding contact with the

creek.

Future Activities

1. DHSS/ATSDR will attend future public meetings and availability sessions to meet with the public and address community health concerns.
2. DHSS/ATSDR will evaluate any further data that becomes available about human exposure or contaminants at these sites.

Preparers of the Report:

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Attachments:


Appendix A:

[Figure 1 - Site Map, 12th Avenue Solvents site](#)

[Figure 2 - Map with Sampling Locations](#)

REFERENCES

1. Agency for Toxic Substances and Disease Registry. Health Consultation, Evaluation of Off-Site Contamination, Sentinel Wood Treating. Atlanta:US Department of Health and Human Services 2 Aug 2001.
2. Missouri Clean Water Commission. Memorandum to Ken Karch from James A. Burris. Subject: Sentinel Wood Treating Company. 1 Oct 1974.
3. Missouri Clean Water Commission. Letter to K.W. Farris, President, Sentinel Wood Treating, Inc. from James A. Burris. 31 Jul 1973.
4. Missouri Clean Water Commission. Application for Variance #00228. From K.W. Farris, Sentinel Wood Treating, Inc. 18 May 1977.
5. Environmental Strategies Corporation. Phase II Site Investigation Work Plan for the Copeland Corporation Facility, Ava, Missouri. 29 May 2001.
6. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Chlorinated Dibenzo-p-dioxins, (Update), Atlanta:US Department of Health and Human Services. Dec 1998.
7. Agency for Toxic Substances and Disease Registry. Fact Sheet for Pentachlorophenol. Atlanta:US Department of Health and Human Services. Sep 1995.
8. Agency for Toxic Substances and Disease Registry. Fact Sheet for Polycyclic Aromatic Hydrocarbons. Atlanta:US Department of Health and Human Services. Sep 1996.
9. Agency for Toxic Substances and Disease Registry. Fact Sheet for Xylene. Atlanta:US Department of Health and Human Services. Sep 1996.
10. Agency for Toxic Substances and Disease Registry. Fact Sheet for Benzene. Atlanta:US Department of Health and Human Services. Sep 1996.
11. Agency for Toxic Substances and Disease Registry. Fact Sheet for 1,2-Dichloroethene. Atlanta: US Department of Health and Human Services. Sep 1997.

12. American Cancer Society. Cancer information database on the Internet (www.cancer.org ). 2001

CERTIFICATION

This Sentinel Wood Treating Site and 12th Avenue Solvents Site Health Consultation was prepared by the Missouri Department of Health and Senior Services under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was initiated.

Roberta Erlwein
Technical Project Officer, SPS, SSAB, DHAC

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

Richard Gillig
Section Chief, SPS, SSAB, DHAC, ATSDR

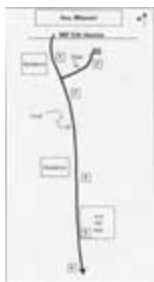
FIGURES



[Figure 1. Site Map, 12th Avenue Solvents site](#)



[Figure 2. Map with Sampling Locations](#)



[Figure 3. Area Map](#)

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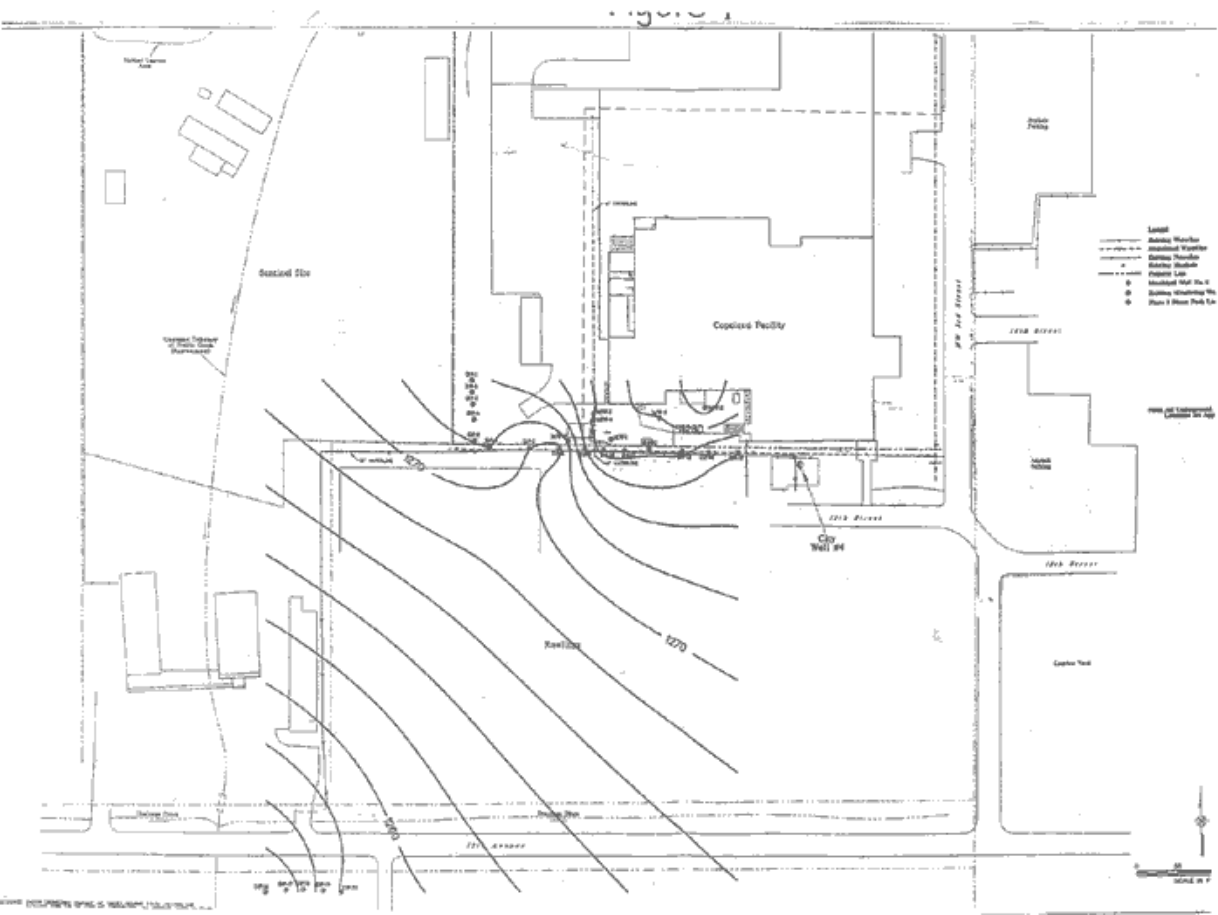
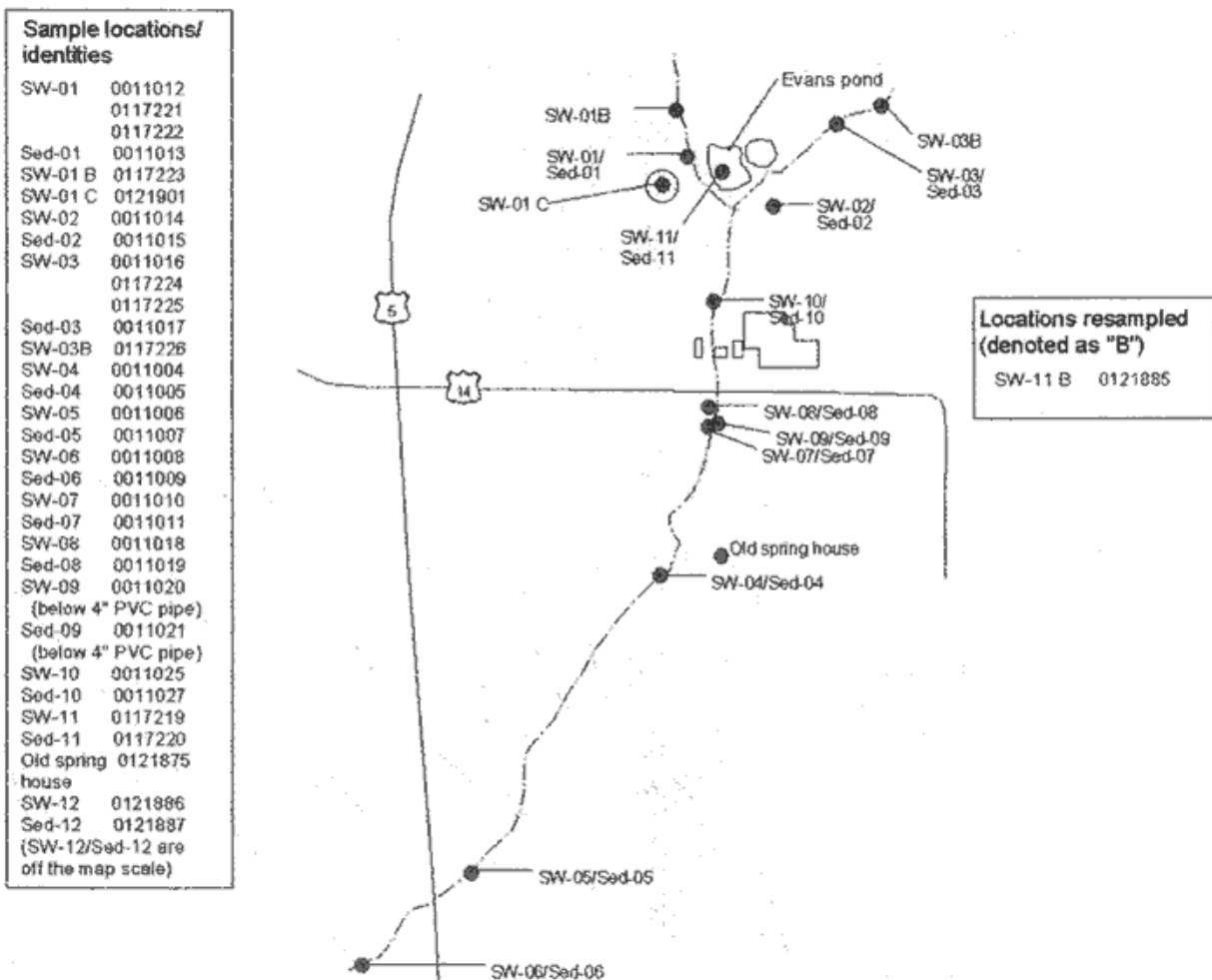


Figure 2

Sentinel Wood Treating Site

Surface water / Sediment Sampling Locations



Legend:



Surface water/sediment sampling point/
identity



Ava, Missouri

N



NW 12th Avenue

Residence

1

Ditch

2

3

Creek

Residence

4

5

Ava
City
Park

6

